

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

1 1 (currently amended): A driver circuit for an ultrasonic transducer, comprising:
2 a current sense circuit coupled to detect a transducer load current;
3 a controller coupled to the current sense circuit and configured to perform a
4 frequency sweep of a driver output to locate a resonance frequency corresponding to peak
5 current;
6 a voltage-controlled oscillator (VCO) coupled to the controller and configured to
7 generate an output signal oscillating at the resonance frequency; and
8 a pulse width modulator coupled to the VCO and configured to modulate an
9 output current of the driver circuit;
10 a first switch and a second switch coupled to the pulse width modulator and
11 configured to switch an amount of the output current in response to the VCO output signal; and
12 an analog-to-digital converter coupled between the current sense circuit and the
13 controller, and configured to convert an analog output signal of the current sense circuit into a
14 digital signal.

2-3 (canceled)

1 4 (currently amended): The driver circuit of claim ~~[[3]]~~ 1 further comprising a
2 digital-to-analog converter coupled between the controller and the VCO, and configured to
3 convert a digital controller output signal to an analog voltage signal.

1 5 (original): The driver circuit of claim 1 wherein the current sense circuit
2 comprises:
3 a current sense resistive element magnetically coupled to the transducer;

4 a low pass filter coupled to the current sense resistive element; and
5 a full-wave rectifier coupled to the low pass filter and configured to generate a
6 DC signal representing the transducer load current.

1 6 (original): The driver circuit of claim 5 further comprising a current
2 transformer coupled between the current sense resistive element and a magnetic coil.

1 7 (original): The driver circuit of claim 5 wherein the low pass filter comprises a
2 fourth order active filter.

1 8 (original): The driver circuit of claim 1 further comprising an alarm circuit
2 coupled between the current sense circuit and the controller, and configured to disable the pulse
3 width modulator when the load current reaches a predetermined threshold.

1 9 (original): The driver circuit of claim 8 wherein the alarm circuit comprises a
2 comparator having a first input coupled to an output of the current sense circuit and a second
3 input coupled to a reference signal corresponding to the predetermined threshold.

1 10 (original): The driver circuit of claim 2 wherein each of the first and second
2 switches comprises a field effect transistor.

1 11 (original): The driver circuit of claim 10 wherein the pulse width modulator is
2 configured to generate a first pulse width modulated signal PWM1 coupled to a gate terminal of
3 first field effect transistor switch, and a second pulse width modulated signal PWM2 coupled to a
4 gate terminal of second field effect transistor switch, wherein the signals PWM1 and PWM2 are
5 non-overlapping pulses.

1 12 (original): The driver circuit of claim 11 wherein the pulse width modulator
2 generates signal PWM1 at one of a rising or falling edge of the output signal of the VCO, and
3 generates signal PWM2 at the other one of the rising or falling edge of the output signal of the
4 VCO.

1 13 (original): A method for driving an ultrasonic transducer, comprising:
2 (a) sweeping a transducer frequency profile to locate a peak load current;
3 (b) defining a reference frequency as the frequency corresponding to the peak
4 current;
5 (c) adjusting an oscillation frequency of an oscillator to the reference frequency;
6 (d) controlling output transistor switches by pulse width modulated signals
7 generated in response to the oscillator output to adjust transducer current; and
8 ~~(e) periodically-repeating-steps-(a)-through-(d)-to-dynamically-adjust-the-reference~~
9 frequency that controls the transducer current.

1 14 (original): The method of claim 13 wherein the step of sweeping the
2 transducer frequency profile comprises an initial round of multiple frequency sweeps with
3 increasing granularity.

1 15 (original): The method of claim 14 wherein the step of sweeping the
2 transducer frequency profile comprises:
3 performing a first broad frequency sweep using a first frequency step to locate a
4 first approximate peak frequency f1;
5 performing a second medium frequency sweep using a second frequency step that
6 is smaller than the first frequency step, the second medium frequency sweep being centered
7 around frequency f1 and yielding a peak frequency f2; and
8 performing a third fine frequency sweep using a third frequency step that is
9 smaller than the second frequency step, the second third fine frequency sweep being centered
10 around frequency f2 and yielding a peak frequency f3.

1 16 (original): The method of claim 13 wherein the step of sweeping the
2 transducer frequency profile comprises a mid-operation sweep centered around the reference
3 frequency.

1 17 (original): The method of claim 13 wherein the step of controlling output
2 transistor switches comprises generating non-overlapping pulse-width modulated signals.

1 18 (currently amended): An ultrasonic system comprising:
2 an ultrasonic transducer; and
3 a driver circuit coupled to the ultrasonic transducer, wherein the driver circuit
4 comprises a microprocessor controlled phase-locked loop that is configured to periodically
5 sweep a frequency profile of the transducer to locate and lock onto a resonance frequency, and to
6 control a current of the transducer by pulse width modulated current switches, said
7 microprocessor having software configured to execute functions including:
8 (a) sweeping a transducer frequency profile to locate a peak load current;
9 (b) defining a reference frequency as the frequency corresponding to the peak
10 current;
11 (c) adjusting an oscillation frequency of an oscillator to the reference frequency;
12 (d) controlling output transistor switches by pulse width modulated signals
13 generated in response to the oscillator output to adjust transducer current; and
14 (e) periodically repeating steps (a) through (d) to dynamically adjust the reference
15 frequency that controls the transducer current.

1 19 (original): The ultrasonic system of claim 18 wherein the driver circuit
2 comprises a current sensor magnetically coupled to the transducer and configured to detect
3 transducer current.

1 20 (original): The ultrasonic system of claim 19 wherein the driver circuit further
2 comprises a voltage-controlled oscillator (VCO) coupled to the microprocessor and configured to
3 generate an output signal oscillating at the resonance frequency in response to a control signal
4 from the microprocessor.

1 21 (original): The ultrasonic system of claim 20 wherein the driver circuit further
2 comprises a pulse-width modulator coupled to the VCO and configured to generate non-
3 overlapping pulse width modulated signals in response to the VCO output signal.

1 22 (original): The ultrasonic system of claim 18 further comprising a container
2 for receiving energy from the transducer, the container having a chamber for holding a liquid
3 containing cells or viruses to be lysed, and the chamber having a least one wall providing an
4 interface between the transducer and the contents of the chamber.

1 23 (original): The ultrasonic system of claim 22 wherein the transducer is
2 directly coupled to the chamber wall.

1 24 (original): The ultrasonic system of claim 22 wherein the transducer is
2 coupled to the chamber wall via a horn, the horn having a vibrating tip for deflecting the
3 chamber wall.

1 25 (original): The method of claim 13, wherein the transducer is driven to lyse
2 cells or viruses held in a container by coupling the transducer to a wall of the container and
3 sonicating the chamber.

1 26 (original): The method of claim 25, wherein the transducer is coupled to the
2 wall of the sample container via a horn.

1 27 (original): The method of claim 25 wherein the transducer is directly coupled
2 to the sample container.